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ON THE CONCEPT OF NORMATIVE EVALUATION OF COST-EFFECTIVENESS OF GLONASS APPLICATION IN COASTAL REGIONS

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Russia promotes the application of GLONASS satellite information system in regional economies. In three regions, the system has already been introduced and is widely used, 21 more regions are introducing the system. Experts believe that this process will take from 3 to 5 years.

The introduction and integrated use of GLONASS pose a number of organisational and economic problems for regional administrations. One of such problems is the evaluation of economic benefit from GLONASS implementation in the region.

Economics has developed a large number of methodological approaches to the calculation of such effects in different fields of satellite information application: Earth's remote probing, crop yield forecasts, forestry, water industry and agricultural monitoring, etc.

However, the research shows that attempts to perform a calculation for various fields of satellite information application at a regional level prove the existing approaches to be inefficient due to the difficulties in obtaining initial data.

To this effect, the authors developed a normative methodical approach to the calculation of the effect of integrated GLONASS application. This approach is meant to fill the existing gap and makes it possible to evaluate the economic benefit of an integrated GLONASS application for different fields.

Key words: satellite information, GLONASS system, concept of normative evaluation of economic efficiency of GLONASS application in the region

One of the innovative phenomena integral to the modern world economy is the aspiration of developed countries to use satellite information (SI) systems widely in different spheres of human activities. In Russia, it is the nationally developed GLONASS system. A promising

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field might be its application in the coastal regions of the country, which serve as contact areas in ensuring successful integration of the Russian Federation into the world economy.

Scientific research and practice show that, among the wide range of problem tasks relating to the integrated and large-scale introduction of this system into the economy of coastal regions, the organisational and economic aspects of managing this process have come to the foreground. Of special importance is the issue of assessing the economic efficiency of GLONASS application in the region.

The analysis of the established methodological approaches shows that the methodology of calculations and identification of integral economic benefit from GLONASS application in the economy of a certain region is far from perfect. At the moment, in the framework of the organisational and economic aspect, the foremost task is to develop such methodological approaches that would make it possible to find compromise methodological decisions yielding at least satisfactory results. The administration of regions and large municipal entities will face the question as to how the integrated and large-scale application of GLONASS will affect the economy of territories. The answer to this question can be approached through the assessment of the potential effect of using GLONASS information in the economies of the corresponding territories. It is worth noting that, alongside the development of major methodological approaches, there is a need for a wide range of practical research: differentiated pricing of GLONASS services, the calculation of coefficients for the shared use of satellite information, organisation of On-line Monitoring Centres (OMC) and regional satellite information databases, maintenance of regional infrastructure, etc.

The problem of assessing the influence of GLONASS on the regional economy requires preliminary theoretical interpretation and model. The following methodological techniques, assumptions and principles can be used to this effect:

1) to use the model of a breakeven chart as an analytical method;

2) to formulate an assumption that the costs and results of GLONASS application in the region will be curvilinear in the breakeven chart;

3) to use the principle of threshold technological limit as an indicator of additional growth of regional economy.

The figure below shows the authors' interpretation of the effect of integrated use of SI on the development of regional economy.

The theoretical interpretation of the model shown in the figure resolves itself into the following. The additional profit represented by the cross-hatched area between the breakeven points BEP_1 and BEP_2 is used for the innovative development of the region triggering additional growth of its economy BCED, which corresponds to the so called technological limit of the regional development of the period t_1t_2.

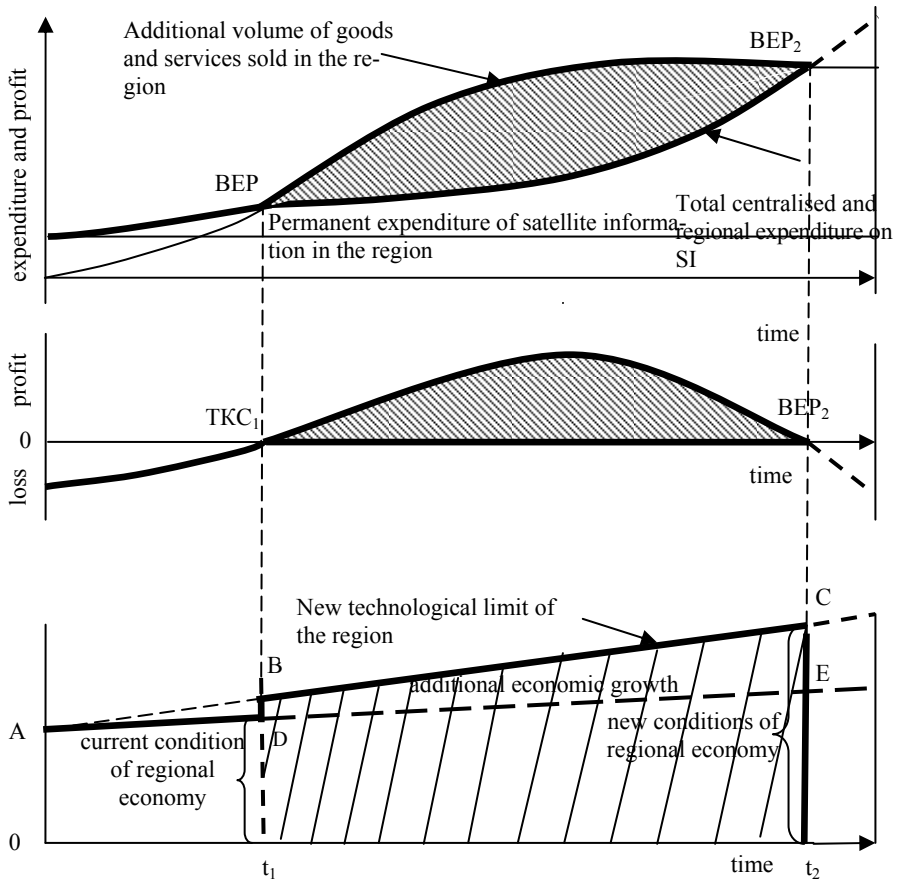

Fig. A theoretical model of the effect of integral application of satellite information on the development of the regional economy

A further step in the transition from a theoretical model of the process to concrete methodological approaches of identifying the economic benefit should be, for example, a general classification of such approaches. Here, it is important to take into account that the information obtained from a spacecraft and underlying administrative and technological decisions can be of two types. The first one is on-line information transmitted from satellites to the ground information reception centres in the real-time transmission mode. In some cases, it can be received after recording and short-time storage on onboard modules and satellites. The other type is offline information. It can be transmitted as photographs of earth and water surfaces, cloudiness, thermal gradient maps to the "Priroda" centre and individual customers for further processing.

To date, judging by the publications and presentations at research fora, a certain package of ideas and approaches to the assessment of GLONASS economic efficiency in the national economy has been developed. Some of them — first of all, in the spheres of nature management, transport, and pre-

vention of damage to certain economic activities and natural resources — reached the stage of a methodology project, although certain complications relating to information support are still arising. Others are at a stage of development of methodological approaches and are to be studied further.

One of the latter is the idea of the development of a macroapproach to the assessment of GLONASS economic benefit at the level of regional administration. The authors' interpretation can be called a ***standard economic benefit from GLONASS application in the region***. From the conceptual point of view, it should be interpreted as a potential economic benefit from GLONASS application over a certain period calculated for all objects (i. e. activities and natural resources) on the basis of a system of generalised efficiency standards.

Here a question arises: who and on the basis of what information will develop such standards? It is well-known that the ***principal problem*** of calculating the economic benefit from GLONASS application by certain consumers and in the region in general lies in the source information. The information on the cost of designing and constructing the satellites, investment in their launching and keeping them in orbit (a group of GLONASS satellites in orbit should consist of 24 units) is accumulated in the research structures of the Federal Space Agency (FSA) of the Russian Federation and is often not available for regional administration and regional OMCs, as well as certain consumers in these territories.

The analysis shows that this problem can be overcome through the centralised development (at the level of the FSA research centres) of average (national) specific standards of the economic benefit from GLONASS application in all economic activities with further adaptation to local conditions by regional administrations.

A general scheme of the suggested methodological approach looks as follows:

1) the centralised development (at the level of the FSA) of specific standards of the economic benefit from GLONASS application throughout the country and in large federal districts — according to economic activities and resources;

2) the development (at the level of the FSA) of methodological recommendations for the adaptation of the system of specific standards to the conditions of certain regions on the basis of adjustment factors. These factors are calculated in the regions on the basis of the recommendations and are agreed upon by the FSA structures.

3) the establishment of departments responsible for regular computation of GLONASS application effect in the monitoring mode within regional administrations. These departments must regularly analyse and formulate proposals for increasing the accuracy of adjustment factors.

4) special departments regularly calculate the economic benefit from GLONASS application according to economic activities carried out in their territories and in the region in general on the basis of the established standards and the system of adjustment factors. Moreover, they should perform local calculations of the economic benefit of emergency damage prevention.

The most general form of the methodological approach to the assessment of standard potential economic benefit from GLONASS application in the region over the period *t* (quarter, year) can be expressed by the following formula

$$Э_{\Sigma}^{p} = \sum_{i=1}^{n} N_{эi} \cdot S_{эi} \cdot K_{эi}^{k} \cdot K_{эi}^{c} + \sum_{k=1}^{m} Э_{ik}^{ny},$$

where $Э_{\Sigma}^{p}$ is the standard potential integral economic benefit from GLONASS application over the period *t* (in value terms);

$N_{эi}$ is the specific standard indicator of the economic benefit from GLONASS application by economic activities over the period *t* (in value terms);

$S_{эi}$ the volume indicator of an activity in the region, where GLONASS is implemented (in corresponding terms);

$K_{эi}^{k}$ is the adjustment factors of GLONASS application for each economic activity in the region (increasing and decreasing factors);

$K_{эi}^{c}$ is the seasonal adjustment factor of GLONASS application in the region;

$\sum_{k=1}^{m} Э_{ik}^{ny}$ is the economic benefit of emergency damage prevention as a result of GLONASS application in the region by economic activities (in value terms);

n stands for the number of economic activities in the region;

m is the number of objects of damage prevention by economic activities.

The proposed formula is preliminary. Studies show that there is a need for further research and experimental calculations aimed at its concretisation and transformation into a working methodology. It involves achieving the following practical research objectives:

1. First of all, there is a need for the development and approval (at the level of FSA research centres) of a methodology for the calculation of the economic benefit from GLONASS application based on the principles of standard potential economic benefit. It should clearly define the sphere of its application by regional administrations.

2. Centralised research on the development of a methodology for calculation and preparation of reference values of the potential nation- and federal districtwide economic benefit of GLONASS application by economic activities over the period *t*.

3. The centralised development of methodological recommendations for the calculation of regional adjustment factors (for regional authorities).

4. The development of adjusting factor references by regional administrations on the basis of methodological recommendations in view of the regional economic and natural features.

When assessing the prospects of applying this conceptual approach, one can state that it fulfills its purpose and does not contradict other methodological approaches of calculating the economic benefit from GLONASS application in the framework of individual enterprises, organisations, and regional industries.

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